

whole. The overfolded mountain limestone of Fig. 1, covered by Boulder-clay, presents many points of interest; the duplication of the fold, just behind the figure in the foreground, is particularly well shown, and the various behaviour of the beds in the anticlinal to the right is most instructive, as is the onion-shaped synclinal, which succeeds it. The second figure illustrates part of an ancient Carboniferous forest which extends over a considerable area around Glasgow, and is not seldom exposed by quarrying operations. The trunks of the trees are rooted in dark coloured carbonaceous shales, and covered with grey sandy shales and flaggy sandstones, in which their débris—branches and fragments of bark—lies scattered; overlying the whole is a sill of intrusive dolerite (unfortunately quarried away, and so not shown in the figure), to which possibly they owe their preservation. It is very gratifying to know that steps have been taken to protect this interesting exposure from the weather by roofing it over, though the scene must thereby lose some of the picturesqueness suggested by the photograph, where the contrast of the graceful living trees with the stumps of the extinct and monstrous Cryptogams (one of these measures 3 feet in diameter) has a very pleasing effect.

The committee is to be congratulated upon the great and general excellence of the work, and the editor of the series for the admirable judgment he has displayed in making a selection from the vast amount of material at his disposal.

ACTION OF ANÆSTHETICS ON PLANTS.

IT not unfrequently happens that the passer-by in autumn is startled to find horse-chestnuts and other spring-flowering trees producing a second crop of flowers. A similar occurrence is not infrequent in pear or apple trees and in the common laburnum. This autumnal flowering is due to one of two causes. In some cases after the flowers have been produced on the "old wood" or on short "spurs," the *Kurztriebe* of the Germans, formed in the previous autumn, other flowers are produced on the long shoots of the present year. The difference in the general appearance of a tree producing its flowers on the "spurs" and of one where the blossoms are produced on the "extension shoots" is often greater than that observable between distinct species, and yet, of course, there is no specific difference between them. The autumnal production of flowers on the yearling shoots is generally assigned, but in a vague, indeterminate fashion, to changes in external conditions. Be that as it may, there are some varieties such as the Napoleon pear which every year behave in this fashion. The operations of pruning are regulated by the way in which the buds are produced on the old or on the new wood of the year, so that the gardener has to take cognisance of appearances which might be, and indeed are, generally ignored by the systematic botanist.

Another cause of autumnal flowering is due to precocity or anticipation. This is the matter which in particular has suggested this note. The flower buds are formed in their usual place, but, for some reason or other, growth and development are hastened, and the flowers which in ordinary circumstances should unfold in the following spring are seen to expand in autumn.

In one of the squares in Paris last autumn the whole or the greater part of the horse-chestnut trees were in bloom, young foliage being interspersed among the flowers. On closer examination it was seen that the older leaves had almost all fallen prematurely or were shrivelled up as if the roots had been deprived in some

way of their necessary supplies of water. Similar instances of autumn flowering are familiar to observers, and they seem generally to be due to summer drought, to removal at an unpropitious period, or to any cause which interferes with the normal course of nutrition. Allusion is made to these phenomena because they throw light on the experiments of Johannsen, of Copenhagen, who was the first to show the effect of ether vapour in hastening the flowering period of various shrubs. The action of the vapour of chloroform and that of ether in arresting the movements of the leaflets of the sensitive plant (*mimosa*) have long been known, but the action has been considered to be purely local.

Matters were in this state when Johannsen pushed his experiments further, and in a different direction, and proved that the flowering of lilacs could be hastened by exposure to the vapour of ether. He thought that if he shortened the resting stage of the shrubs during which their activity is dormant, he would be enabled to induce the earlier and more rapid production of flowers. Exposure to the vapour of ether he found arrested the growth of the plant and secured its earlier and more complete "rest." Johannsen's experiments have been repeated on a large scale in Germany and in France, the general method of procedure being the following. In a case as nearly air-tight as possible, the lilac bushes are placed at a temperature of about 65° F. Light is excluded. From the top of the case is suspended a small cup into which the ether is poured by means of a funnel through an aperture, made for the purpose, and immediately closed. Owing to the explosive nature of the vapour the greatest care must be taken to avoid the presence of any flame. Thirty or forty grammes of ether are enough for a hundred cubic litres of air. The plants are subjected to the influence of the vapour for forty-eight hours. On their removal from the ether chamber the leaves fall, if they have not already done so. The plants are then removed to a cool house and gradually subjected to forcing in the ordinary manner.

By these means the expansion of the blooms is hastened, the etherised plants producing their blooms several days before those treated in the ordinary manner. The gain of a few days is a matter of great importance to the grower for market in the winter season, as he gets so much better a price for his goods. Moreover, the cost of fuel is reduced, for the same amount of heat is not required for forcing, as we have seen that the time required is diminished. Not only lilacs, but many other flowering shrubs have been experimented upon, and with such good results that the process has been adopted on a large scale, and in our own country Mr. Jannoch has, we learn, adopted the plan with most successful results.

A writer in the *Jardin* of January 20 narrates how he exposed plants of lilacs to the vapour of ether in the manner above described on December 7, removed them to the greenhouse on December 9, and on January 1 the flowers were sufficiently expanded for use in the decoration of his apartments. Other varieties followed at a few days' interval. *Spiraea Thunbergii* etherised on December 7 was in full bloom on December 24.

M. Minier, who made these experiments, placed his apparatus in a temperature of 13°–16° C., and the plants were subjected to the ether vapour for forty hours. They were afterwards placed in a house where the temperature ranged from 13°–16° C. at night to 15°–18° C. by day.

The photographs showing the contrast between the etherised and the non-etherised plants are very remarkable and bear witness to the value of the process in securing bloom in the dull season when the chrysanthemums are beginning to go off. It is noteworthy

that the operation is most successful in November and December, and that if delayed until January the results are not so serviceable, as flowering plants can then be obtained in the ordinary way.

It is surmised that the anæsthetics act by causing the removal of the water from the protoplasm, thus drying it up to a certain extent and causing a suspension of its activity. Dr. Johannsen's observations are summarised in a *brochure* published in French by M. Maumené, and entitled "Nouvelle méthode de culture forcée des arbustes et des plantes soumis à l'action de l'éther et du chloroforme," Paris 1903. Abstracts from these publications have been given in various Continental and English horticultural journals, particularly in the October part of the *Journal* of the Royal Horticultural Society, which contains a paper on the subject by M. E. Lemoine, of Nancy, to which reference may be made for fuller details.

M. O. CALLANDREAU.

IT is but a short time since one read in the *Bulletin Astronomique* the words of generous appreciation and sympathy with which M. Callandreau committed to the grave the remains of his friend and colleague M. Prosper Henry. There was no suspicion then that in a very short time his own funeral oration would have to be spoken, or that the staff of the Paris Observatory was so soon to suffer another almost irreparable loss by the removal of another zealous officer equally renowned, equally devoted to the interests of the observatory, but adding to its reputation in a very different direction.

For many years attached to the service of the observatory, M. Callandreau took part in the routine observations, more especially confining himself to the extra-meridional work. Small planets, comets, double stars, each in turn came under his notice, but though a skilful and painstaking observer, he will not be remembered for his diligence in this direction.

Trained in a school directed by profound mathematicians, in which, perhaps, the influence of Gylden can be recognised, and gifted with an unusual analytical skill, he attacked nearly all the questions of celestial mechanics, and everywhere left traces of his powerful and inventive mind. His acquaintance with all the resources of analysis as applied to the practical needs of astronomy enabled him not only to improve the methods employed in some of the more recondite applications of mathematics to astronomical problems, but induced him to open up new paths of inquiry, which are likely to exercise no inconsiderable influence on many questions of abiding interest and prime importance. It will be sufficient here to refer to his method of treatment of definite integrals which occur in the calculations of planetary perturbation, to the consideration he gave to the troublesome question of perturbations of small planets in which the mean motion is nearly commensurable with that of Jupiter, to his occasional references to the theory of the moon, to the figures of the planets, to problems in geodesy, to show how wide an outlook he possessed over the necessities and the difficulties of mathematical astronomy. It is perhaps in some measure to be regretted that his attention wandered over a variety of inquiries, for if everywhere he illuminated the subject under discussion, greater concentration in a particular subject might have added to his reputation and left a deeper mark on the history of his time. Perhaps his "Contributions to the Theory of Cometary Capture" comes nearest to a complete treatise, and his services in this department of astronomy will be long remembered. Some of his papers bear marks of being

suggested by his professorial work in connection with the École Polytechnique, where he occupied the chair of astronomy. His life was a busy one, divided between his duties at the observatory and his professorial engagements, while his kindness of disposition induced him to give willing assistance to those who applied to him. The writer of these few lines gratefully acknowledges more than one kindness he has received at the hands of this distinguished mathematician and astronomer.

Member of the Paris Academy of Sciences and honoured in his own country and among his colleagues, we look in vain for his name among the foreign associates of the Royal Astronomical Society. The kind of work on which he concentrated his attention does not appeal to a numerous class of astronomers, especially would it fail to collect the suffrages of amateurs. But those who read his numerous papers will admit the ability by which they are distinguished and the informing character of their contents. We extend a respectful sympathy to the institution that is bereft of his services, to his colleagues who lose an illustrious example, and to his pupils who are deprived of an able and encouraging teacher. W. E. P.

NOTES.

AN important step has been taken by the Colonial Office, in conjunction with the Imperial Institute, in giving expert assistance to a project of the British Cotton-Growing Association to start cotton growing on a large scale in southern Nigeria. A detailed examination is to be made of several promising districts in the Protectorate, in order to determine the suitability of the soil, climate, &c., for planting cotton, the most important of these districts being the Sobo plains near the coast, where the Ethiopie and Jamieson Rivers enter the sea. Mr. W. G. Freeman, of the scientific staff of the Imperial Institute, formerly of the Department of Agriculture of the West Indies, has just left England under instructions from the Colonial Office to cooperate in this matter with Mr. P. Hitchens, the local forestry officer in southern Nigeria, whose services have been placed at the disposal of the British Cotton-Growing Association by the local Government. In the event of a favourable decision being arrived at, the Colonial Office intends to render every assistance to the British Cotton-Growing Association in organising the arrangements for cotton cultivation in southern Nigeria, which will be commenced this season, and on the results of these preliminary operations the extension of cotton cultivation in the Protectorate will depend.

AFTER practically fifty years' connection with the Berlin Observatory, Prof. Förster proposes to retire from the directorship, to which he succeeded on the retirement of Encke. The knowledge that he can survey a long period of activity and of successful work, and that he carries with him the hearty appreciation of his colleagues, will be to him a source of satisfaction in his well merited retirement and leisure. The observatory that he leaves to his successor and the problems that engage attention now are different from those that he took over from Encke. It would be interesting to compare the present state of the observatory and its instrumental equipment with the condition in which Prof. Förster found them when he joined the staff. In those ancient days the work of the observatory was to some extent hampered by the preparation of the national ephemeris, which, under the title of "Encke's *Astronomisches Jahrbuch*," attained such well deserved consideration. Gradually the Rechen Institut has separated itself more and more from the observatory, until the name of the